A vertical decorative bar on the left side of the slide, composed of five horizontal stripes in red, green, blue, orange, and green from top to bottom.

Guide elements in toolmaking - Professional selection and maintenance

11th April 2024

B.Eng. Julian Ostfalk | FIBRO GmbH

5th WORKSHOP Forming and Punching

Guide Elements in toolmaking

Professional selection and maintenance

Tasks / Challenges / Solutions

Tasks

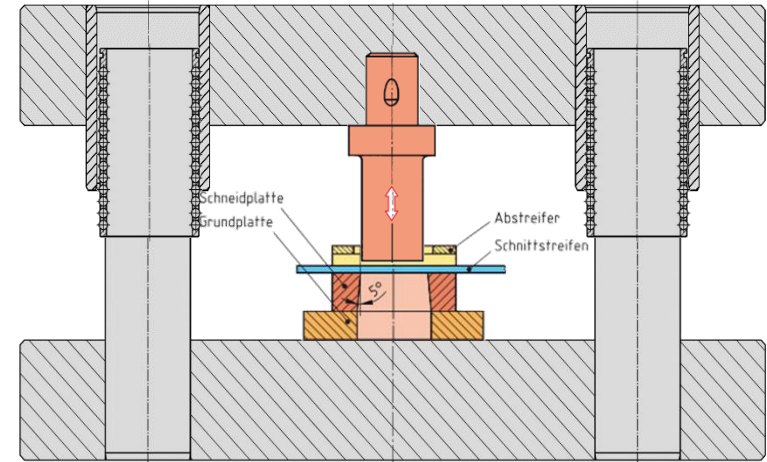
- Sufficient part quality
- Low maintenance effort

Challenges

- Tilting/Shifting caused by press
- Tilting/Shifting caused by process

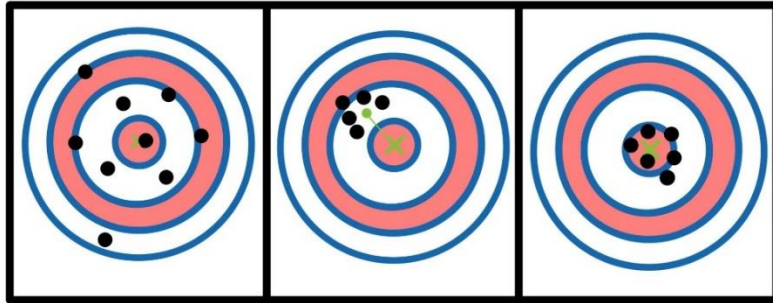
Solutions

- Guiding accurate and repeatable
- Absorbing forces and torques



Guide Elements in toolmaking

Professional selection and maintenance



**Inaccurate
and
Imprecise**

**Inaccurate
but
Precise**

**Accurate
and
Precise**

Definition – Accuracy / Precision

Accuracy

„Accuracy is how close a given set of measurements are to their true value“

-> Accurate

Precision

„Precision is how the measurements are to each other“

-> Repeatable

Guide Elements in toolmaking

Professional selection and maintenance

Technical paper – Influence of guide elements

Influence

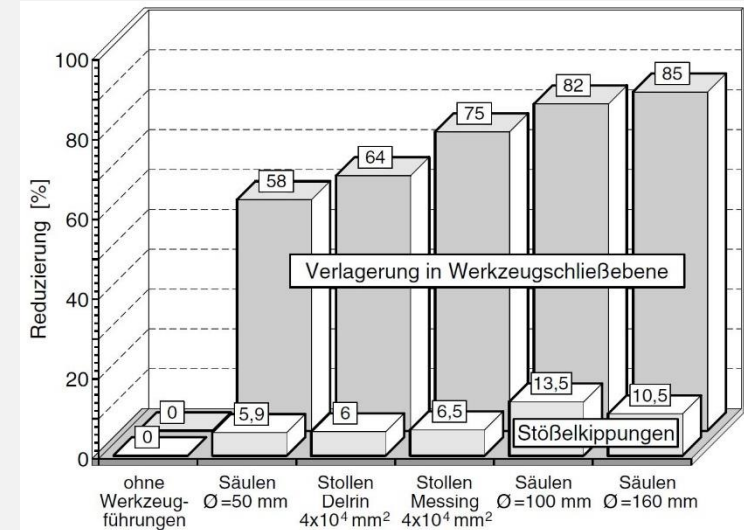
- Reduction of tilting up to 13,5%
- Reduction of shifting up to 85%

Requirements

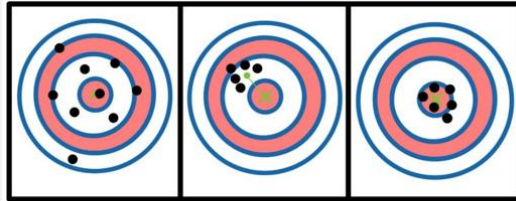
- Stiffness of tool and press
- Quality of tool and press

Technical paper:

Guide elements in tools and accuracy behaviour of press und die set – H.-W. Wagner, H. Riese



Führungsart	C-Pressen	Rahmenpressen Stanzautomaten
Grauguß	ca. 10 m	ca. 12 m
Gießharz	8	10
gehärt. Stahlbuchse	8	10
" " m. automat. Schmier.	12	15
Bronce	12	15
Sintereisen carbonitriert	15	25
Kugelführung	20	50 u. darüber



**Inaccurate
and
Imprecise**

**Inaccurate
but
Precise**

**Accurate
and
Precise**

Sliding bearings - General

Suitability

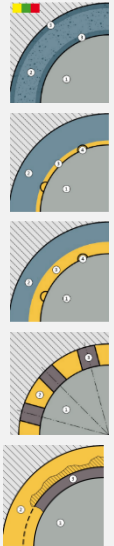
- High loads / High impacts

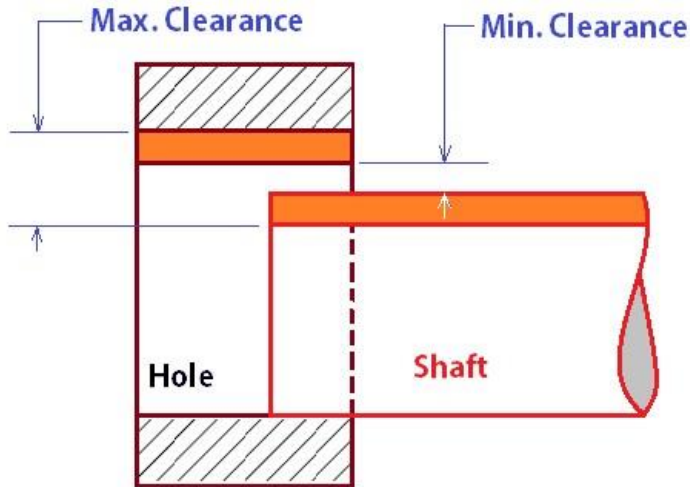
Risks

- Self-locking of guide-elements
- Inaccurate and imprecise

Limits

- Maximum speed: 15 – 25 m/min
- Maximum strokes: ~ 400 strokes/min





Sliding bearings - ISO II limits and fits

Clearance fit

„Dimensions of hole and shaft are such that always clearance or gap is existing between hole and shaft”

2-pillar-die sets

20 - 50% of single clearances consumed

4-pillar-die sets

Over 50% of single clearances consumed

Sliding bearings - Tribology

Target

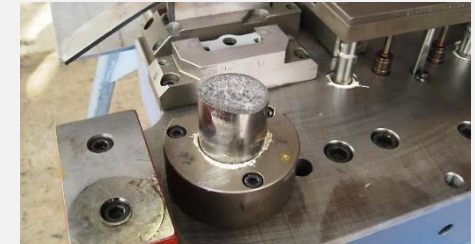
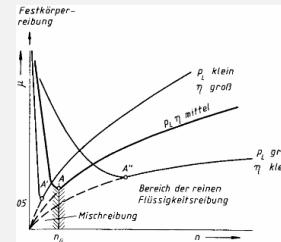
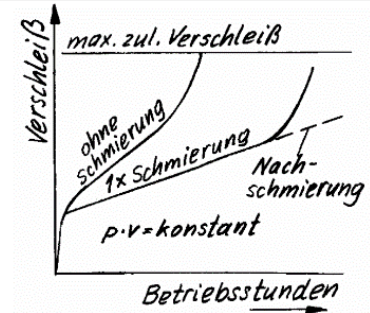
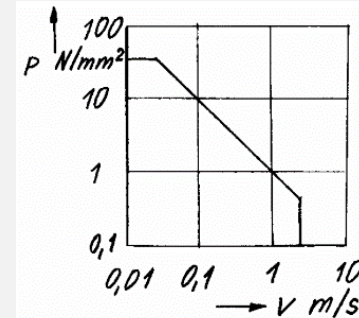
- Low maintenance effort
- Low friction

Risks

- Insufficient lubrication film (insufficient heat transportation)

Aspects

- Specific bearing load ($p \cdot v$ – value)
- Environmental conditions



Slide guide, bronze-plated (ECO-LINE)

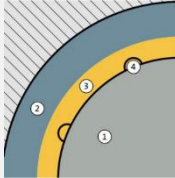
Guide bush: $\varnothing 25H5 (+0,009/+0,002)$

Pillar: $\varnothing 25h4 (-0,002/-0,006)$

Max. clearance: 0,015mm

Min. clearance: 0,004mm

$\Delta 0,011\text{mm}$



Precision slide guide, sintered ferrites

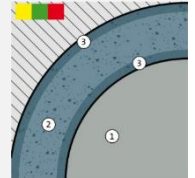
Guide bush: $\varnothing 25 (+0,019/+0,014)$

Pillar: $\varnothing 25 (-0,004/-0,006)$

Max. clearance: 0,025mm

Min. clearance: 0,018mm

$\Delta 0,007\text{mm}$



Slide guide with non-liquid lubricant pockets

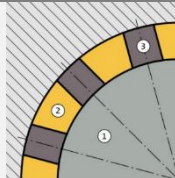
Guide bush: $\varnothing 25H7 (+0,021/+0,000)$

Pillar: $\varnothing 25f6 (-0,020/-0,0033)$

Max. clearance: 0,054mm

Min. clearance: 0,020mm

$\Delta 0,034\text{mm}$



Precision slide guide, sintered ferrites

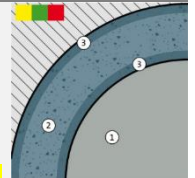
Guide bush: $\varnothing 25 (+0,012/+0,007)$

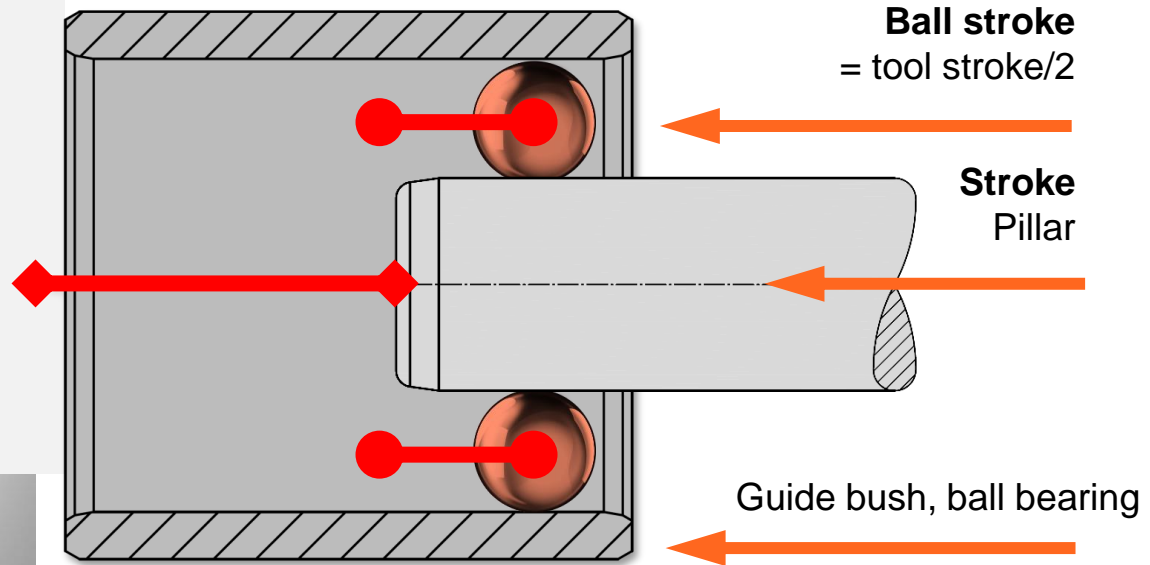
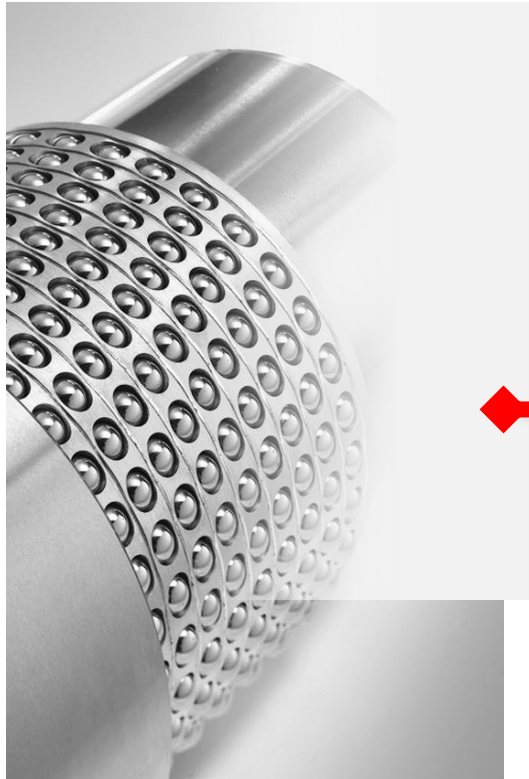
Pillar: $\varnothing 25 (-0,000/-0,002)$

Max. clearance: 0,014mm

Min. clearance: 0,007mm

$\Delta 0,007\text{mm}$





Ball bearings - General

Suitability

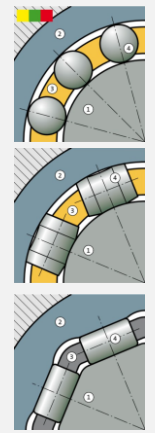
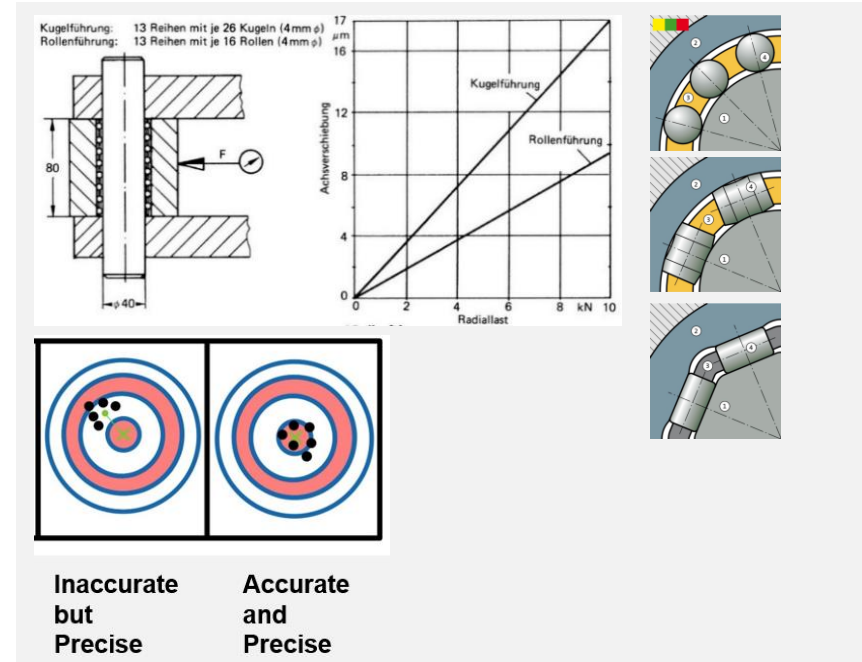
- High precision, low friction, (flexibility)

Risks

- Flexibility -> low accuracy
- Stroke limit

Applications

- Applications starting from ~ 400 strokes/min





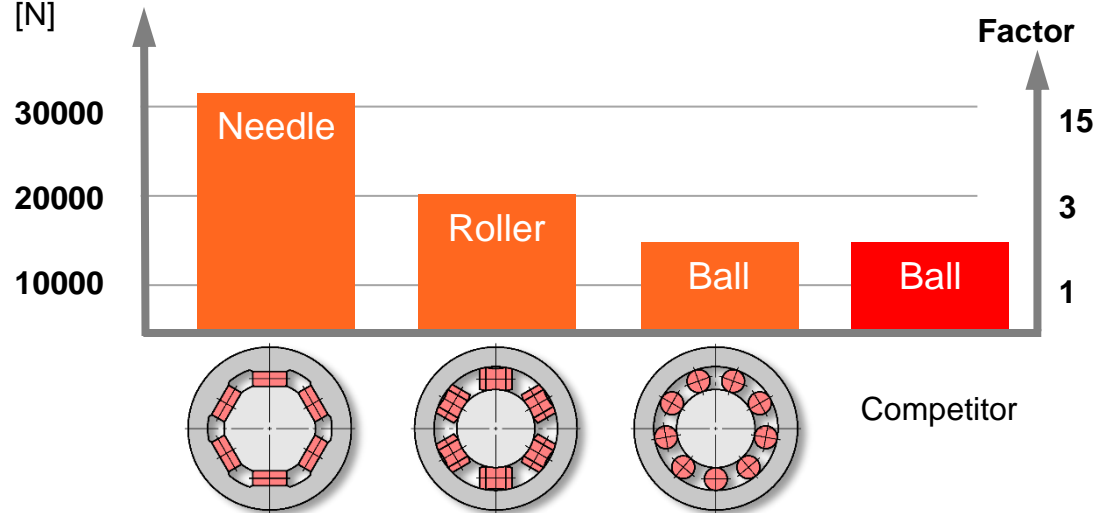
Comparison

For diameter 40mm

Nominal bearing life

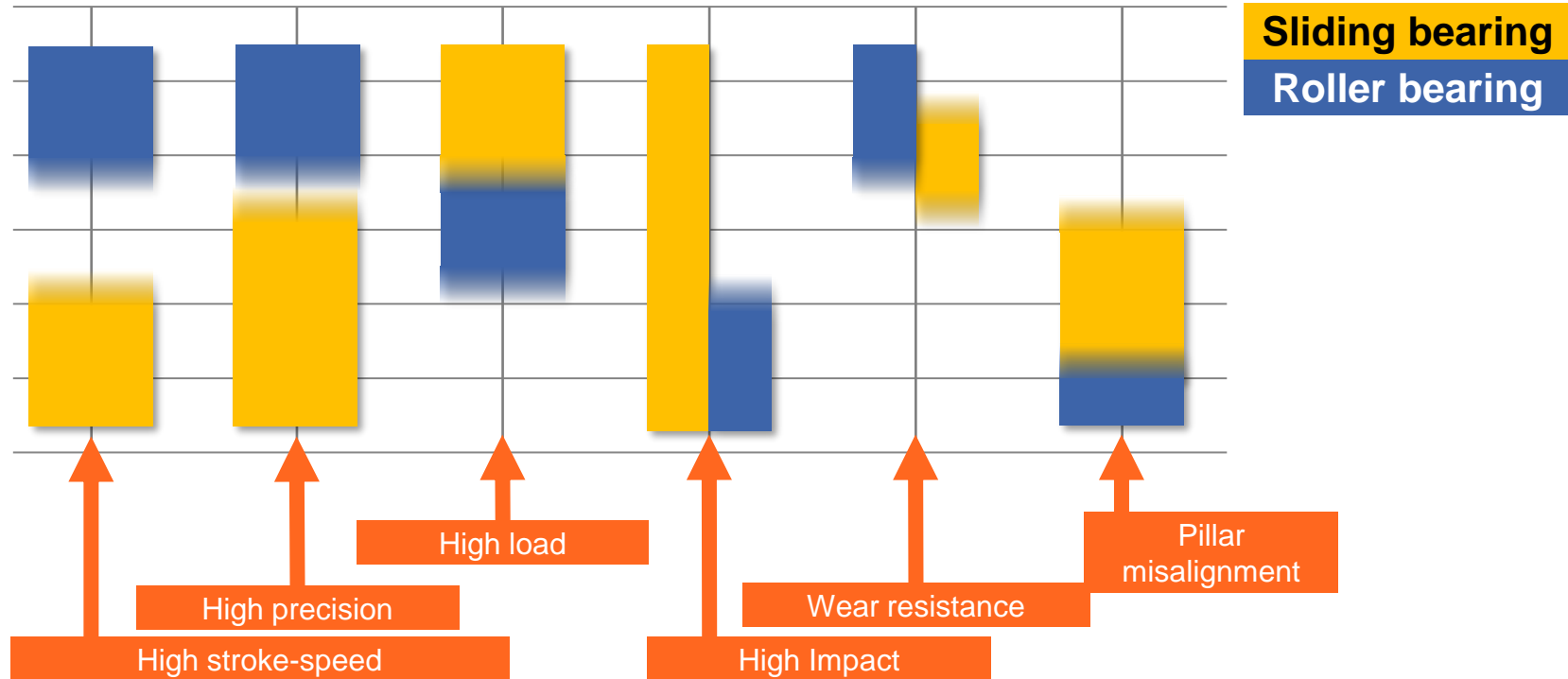
$$L_h = \frac{833\,333}{2 \cdot H \cdot n_f} \cdot \left[\frac{C}{f_s \cdot F} \right]^3$$

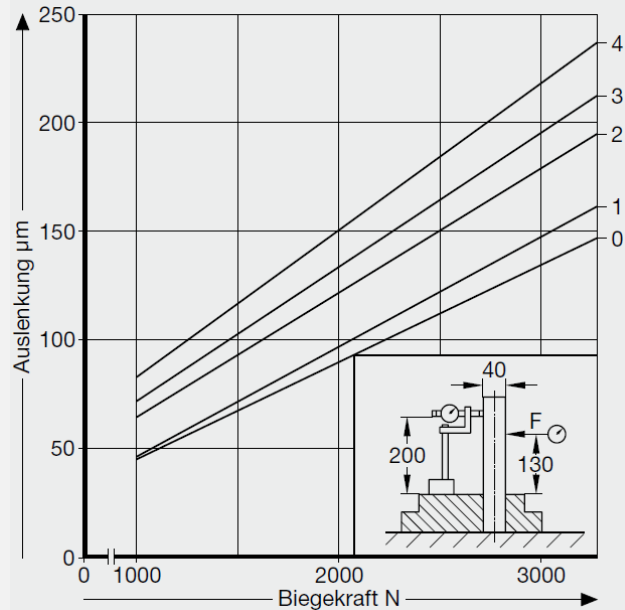
Dynamic load index C [N]



Competitor

Professional selection and maintenance





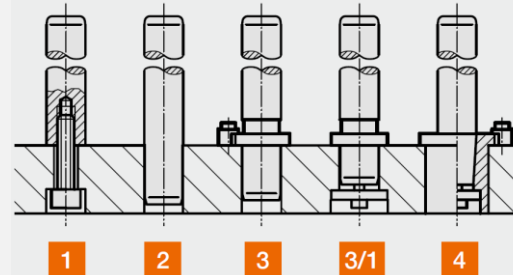
Pillar mounting

Stiffness

- Mainly depending on type of mounting

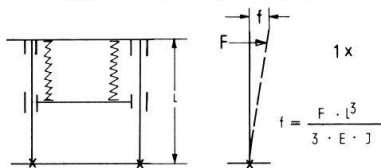
Load capacity

- Mainly depending on mounting place
- Mounting on movable plate 8 times higher

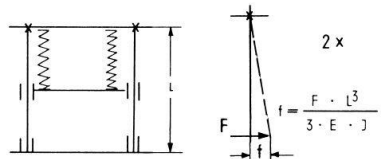


Guide pillar with center fixing

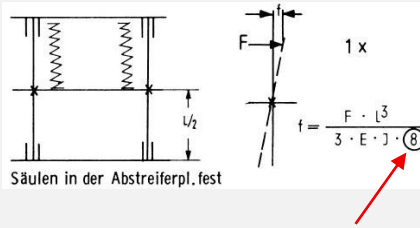
Werkzeugtyp-Belastungsfall-Biegegleichung-Spiele



Säulen im Unterteil fest



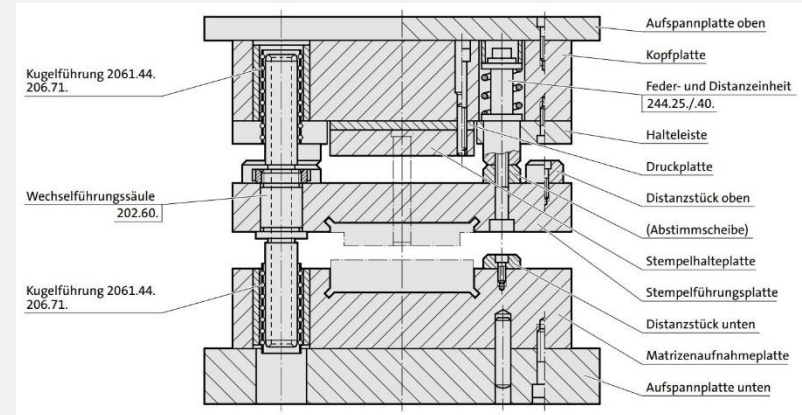
Säulen im Oberteil fest



Säulen in der Abstreiferpl. fest

- Stiffness 8-times higher

Progression lamination die set unit



Sliding guides - Slip stick effect

Problem: Self-locking of guide-elements

Trigger: Torques / outer-middle forces

Factors: Short guide length / high friction / low stiffness and quality

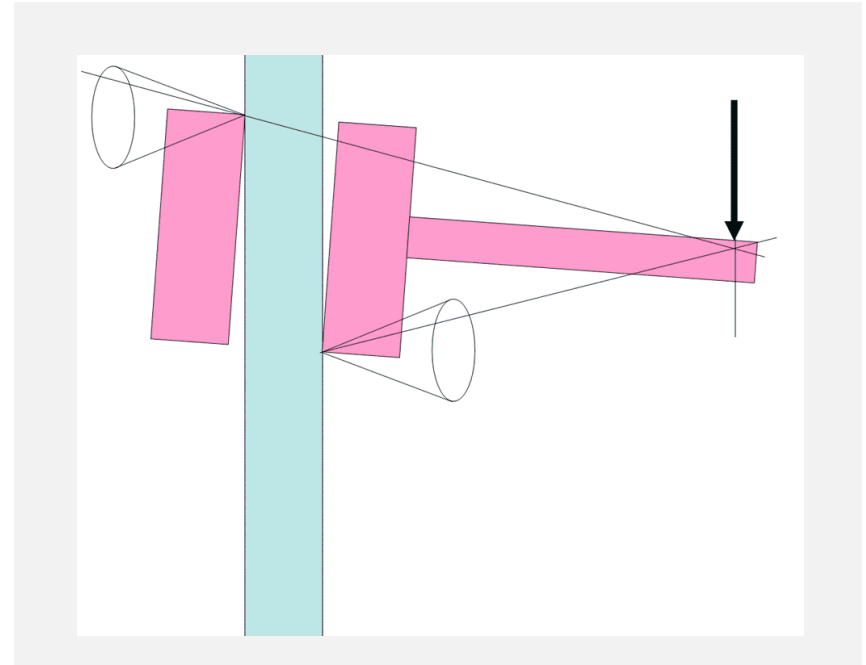
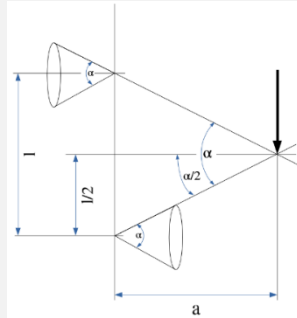
Formula:

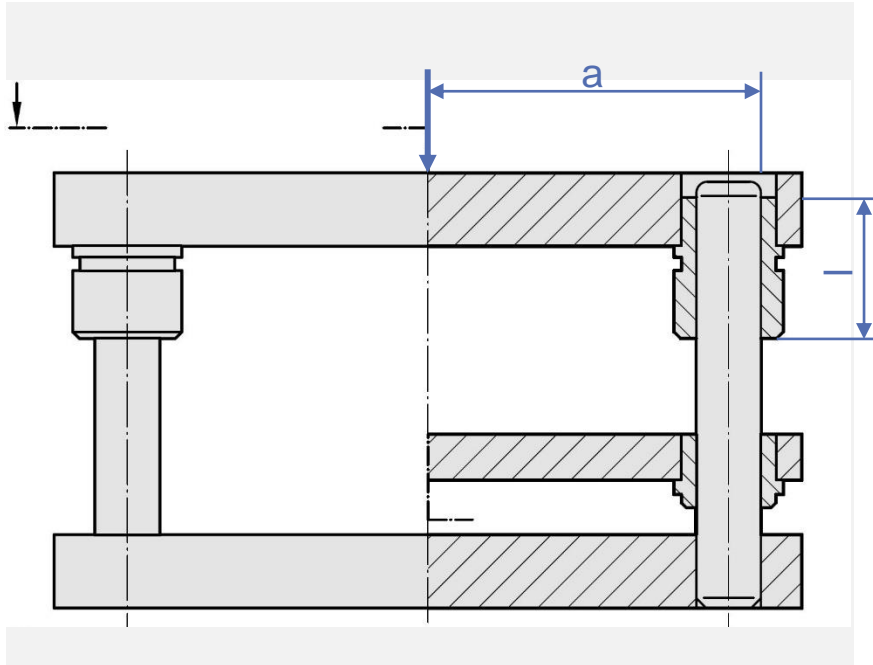
$$L > 2 * a * \mu$$

L .. Guide length

a ... gap

μ .. Co-efficient of friction





Sliding guides - Slip stick effect

Problem: Self-locking of guide-elements

Trigger: Torques / outer-middle forces

Factors: Short guide length / high friction / low stiffness and quality

Formula:

$$L > 2 * a * \mu$$

L .. Guide length

a ... Gap

μ .. Co-efficient of friction

Multiple guiding systems

Combination of multiple guiding systems...

... for increasing accuracy and stiffness

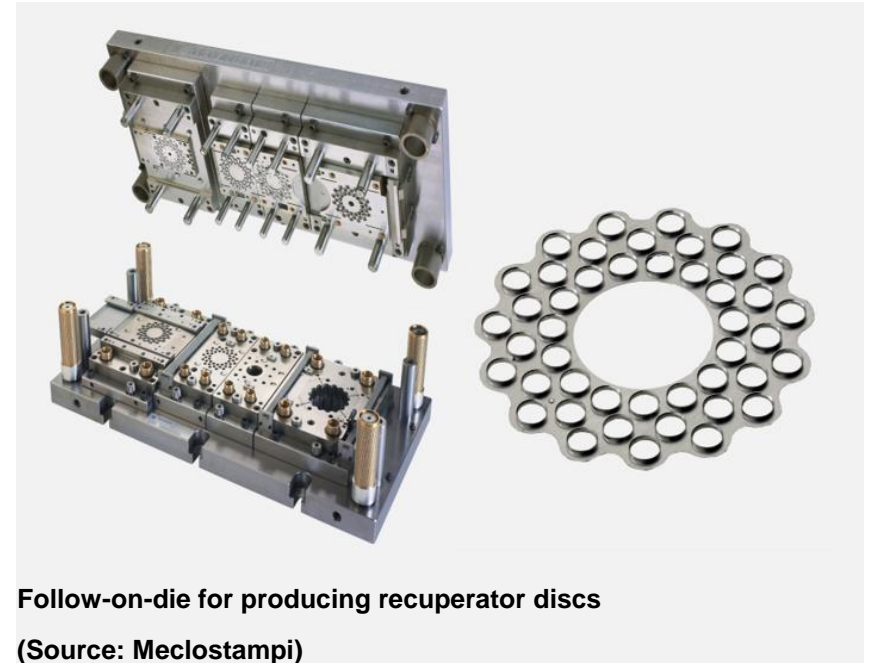
... for covering quality issues

Results

- Insignificant increasing of accuracy
- Significant increasing of maintenance effort

Solution

- High precision and accuracy at working position with centering-elements



Follow-on-die for producing recuperator discs

(Source: Meclostampi)

Sources

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